LOW MINIMUM TEMPERATURES OF JUNE 12-13, IN THE FAR WEST

GROVER D. HUGHES AND ROBERT B. ROSS
WBAN Analysis Center, U. S. Weather Bureau, Washington, D. C.

INTRODUCTION

During the month of June 1952, upper level pressures were below normal on the West Coast with resultant below-normal mean temperatures in the Far West [1]. This article deals with the most intense cold outbreak of this period, the record to near record breaking minimum temperatures in California, Nevada, Oregon, Washington, and Idaho on the mornings of the 12th and 13th of June. The cold surge that caused these low temperatures is traced from Alaska to the West Coast. The movement of the cold air inland immediately followed by warm advection can be accounted for by the shifting in orientation of the upper level trough. The shifting of this trough is shown to be directly related to additional influxes of cold air from Canada.

ANTECEDENT CONDITIONS

A surface wave, which developed off the east coast of Japan on June 1, had moved by June 6 to a position just south of Dutch Harbor, Alaska, and there reached a maximum depth of 973 mb. This storm was unusually intense for this time of the year [2].

The upper level charts for June 6 showed that exceptionally cold air flowing southward from Bering Sea had moved in behind the deep surface storm. The surface storm filled as it moved northward over Bering Sea and its surface fronts dissipated. However, the cold air aloft moved to the east giving temperatures at 700 mb. of −10° C. at Bethel, Alaska, −16° C. at Adak, Alaska on June 7, and −13° C. at Anchorage, Alaska on June 8. These temperatures are near the record for June for the short period that upper air soundings have been taken in that area [3].

The cold Low maintained a closed circulation at 500 mb. and began to move to the southeast, although surface pressures over the northeast Pacific remained relatively high. The approach of the cold air, which at 700 mb. was centered south of Kodiak, Alaska on June 8, encouraged the flattening of the sharp north-south surface ridge in the eastern Pacific and the building of a warm ridge over western Alaska. By the morning of the 10th the 500-mb. low pressure system, which had deepened somewhat and now appeared as a closed circulation at the 700-mb. level, was centered off the British Columbia coast. An old cut-off Low which had been stationary for more than a week off the California coast now moved inland with subsequent frontogenesis over the Plateau Region.

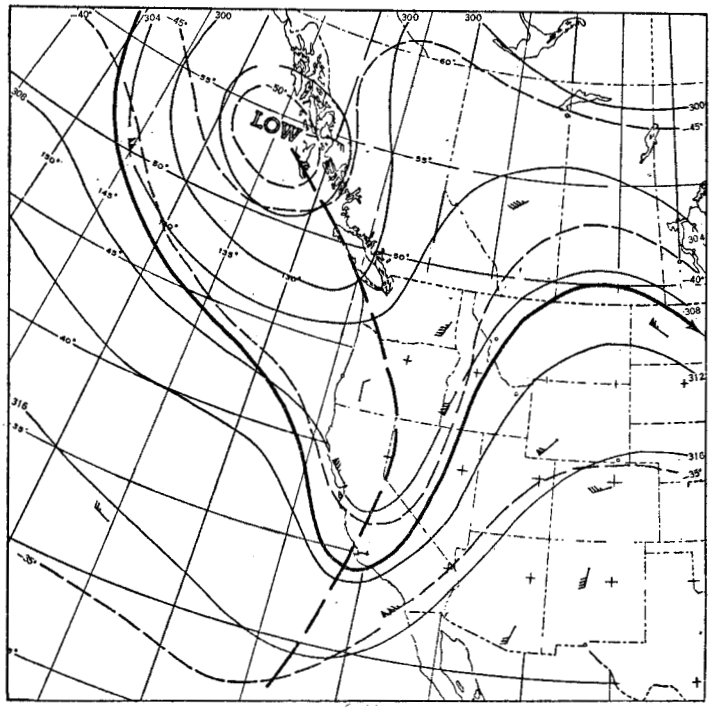

FIGURE 1. 300-mb. chart for 0300 GMT, June 10, 1952. Contours (solid lines) at 400-ft. intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are in intervals of 5° C. Heavy dashed line represents low-pressure trough. Heavy solid line represents jet stream. Barbs on wind shafts are for wind speeds in knots; full barb=10 knots, half barb=5 knots, and pennant=50 knots.

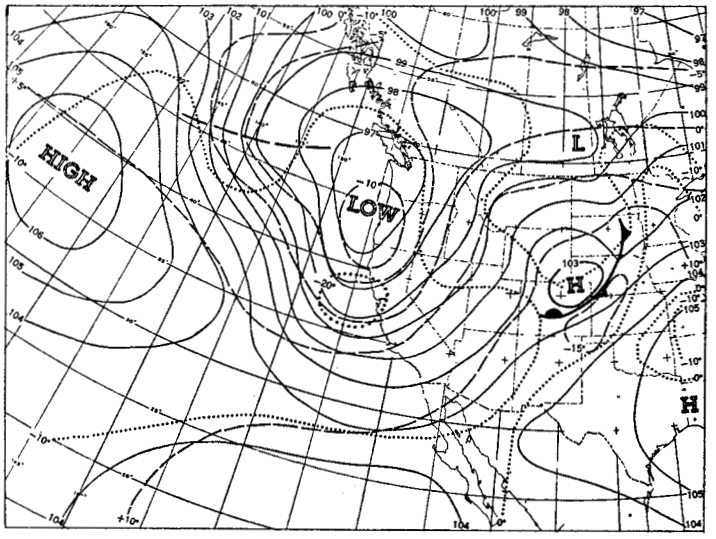

FIGURE 2.—700-mb. chart for 1500 GMT, June 11, 1952. Contours (solid lines) at 100-ft. intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are at intervals of 5° C. Isograms of dew point temperature (dotted lines) are at intervals of 10° C. Heavy dashed line represents low-pressure trough.

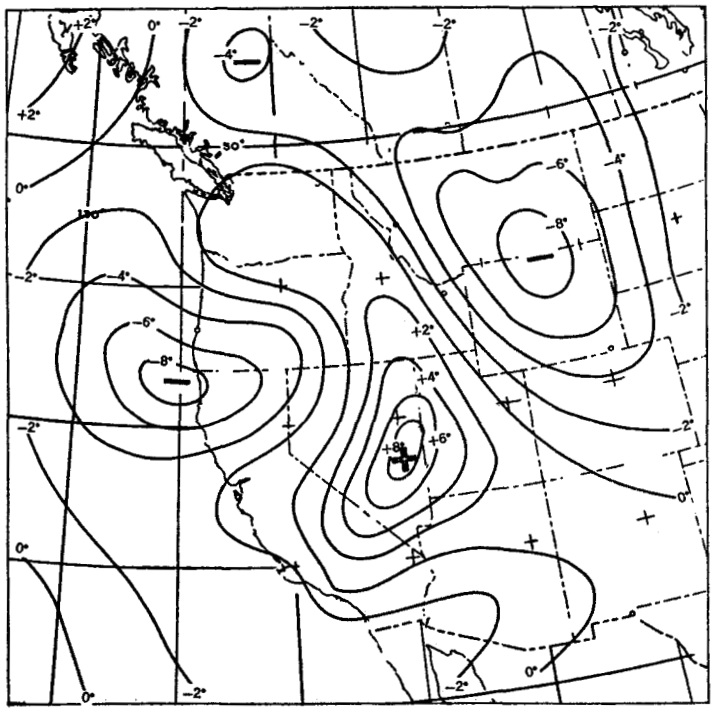

FIGURE 3.—700-mb. 24-hour temperature change chart from 1500 GMT, June 10 to 1500 GMT, June 11, 1952.

The combination of these two systems formed a major low pressure trough over the far western United States. The axis of this trough at 300 mb. was oriented in a southeasterly direction from Annette, Alaska to Reno, Nev., thence curving to the southwest (fig. 1). At this stage the axis of the 300-mb. trough had its maximum slant to the southeast.

MOVEMENT OF COLD AIR INLAND

The 700-mb. chart for June 11 at 0300 GMT (not reproduced) shows that the cold air had moved southward to just off the Washington-Oregon coast producing near record 700-mb. temperatures at Tatoosh and Seattle, Wash. [3]. Twelve hours later the 700-mb. temperature at Medford, Oreg. fell to −12° C. (fig. 2), about 4° colder than the previous record at this station during June over a 6-year period [3]. The rapid temperature changes that were taking place aloft over the West are indicated by the 24-hour 700-mb. temperature change charts, June 10 to June 13 (figs. 3, 4, and 5).

After the Low aloft had reached the Oregon coast a tongue of cold air moved inland with cyclogenesis taking place at the surface over Idaho and Nevada (fig. 6). By 0030 GMT, June 12, cold frontogenesis was indicated from western Montana southward to southern California with snow showers reported over the mountain areas of Oregon and northern California. The intensity of the cold air at 700-mb. is indicated by the temperatures of −7.5° C. at Oakland, Calif. at 0300 GMT, June 12, and −9° C. at Boise, Idaho, at 1500 GMT, June 12, both near record for June.

LOW SURFACE TEMPERATURES

On the morning of the 12th minimum surface temperatures were unusually low over Washington, Oregon, Nevada, and California (fig. 8) with many stations reporting new minimum temperature records for June (see table 1). Frost occurred in local areas of northern California,

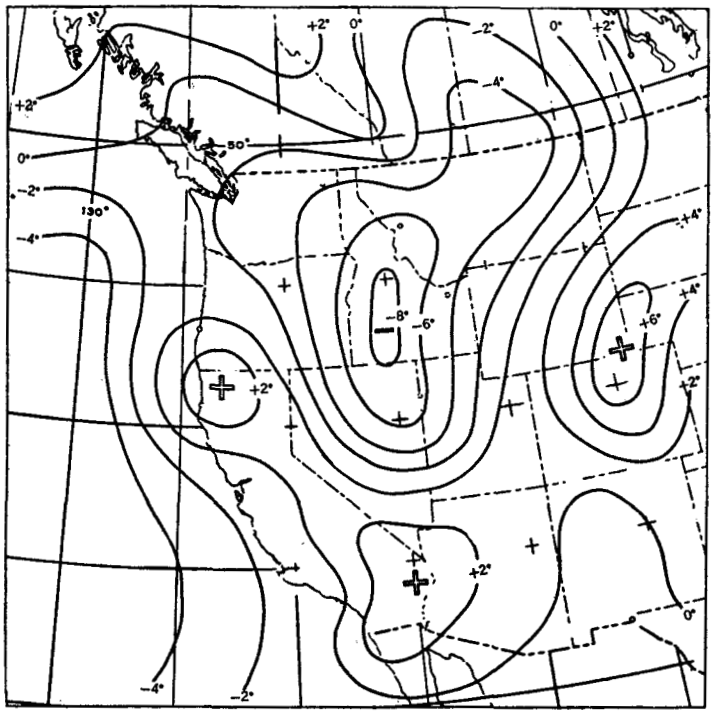

FIGURE 4.—700-mb. 24-hour temperature change chart from 1500 GMT, June 11 to 1500 GMT, June 12, 1952.

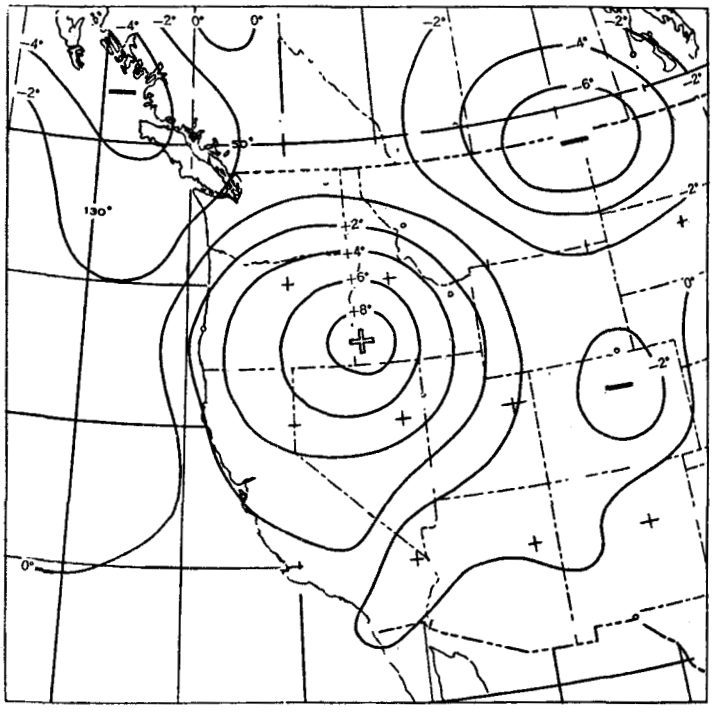

FIGURE 5.—700-mb. 24-hour temperature change chart from 1500 GMT, June 12 to 1500 GMT, June 13, 1952.

TABLE 1.—*Some June minimum temperature comparisons*

	Min. temp. June 12 or 13, 1952	Previous June record min. [4]	Remarks
California	°F.	°F.	
Blue Canyon	28		1.4 inches snow, June 11.
Eureka	43	40	
Fresno	47	42	
Mount Shasta	25		*"A killing frost on the morning of the 12th . . . on the valley floor where temperatures were quite likely as much as 4° or 5° colder than observed at this station." Trace of snow on the 11th.
Oakland Airport	46	42	
Red Bluff	42	43	New record for June.
Sacramento	44	43	† Lowest temperature for so late in the month.
Oregon			
Baker	32	27	
Eugene	37	36	
Lakeview	28		Trace of snow on the 12th.
Meacham	32		Trace of hail on 11th, trace of snow on 12th.
Medford	31	32	New record for June.
Pendleton	40		Trace of snow on 12th.
Roseburg	35	36	New record for June.
Salem	41	32	
Saxton Summit	29		*1.5 inches of snow on 11th, trace of snow on 12th. "Lowest June temperature on record."
Washington			
Ellensburg	33		* "Lowest temperature ever recorded so late in the season."
Olympia	36		*†"Lowest June temperature since June 14, 1945."
Spokane	38	34	
Tatoosh	44	43	
Nevada			
Elko	27		*†"Lowest June temperature since June 14, 1945."
Fallon	30		
Lovelock	29		
Reno	27	28	*New record for June. Killing freeze on 12th caused widespread damage.
Winnemucca	30	29	

*Quoted from remarks section of June 1952 *Local Climatological Data* for each station.
† From the *Weekly Weather and Crop Bulletin*, June 13, 1952.

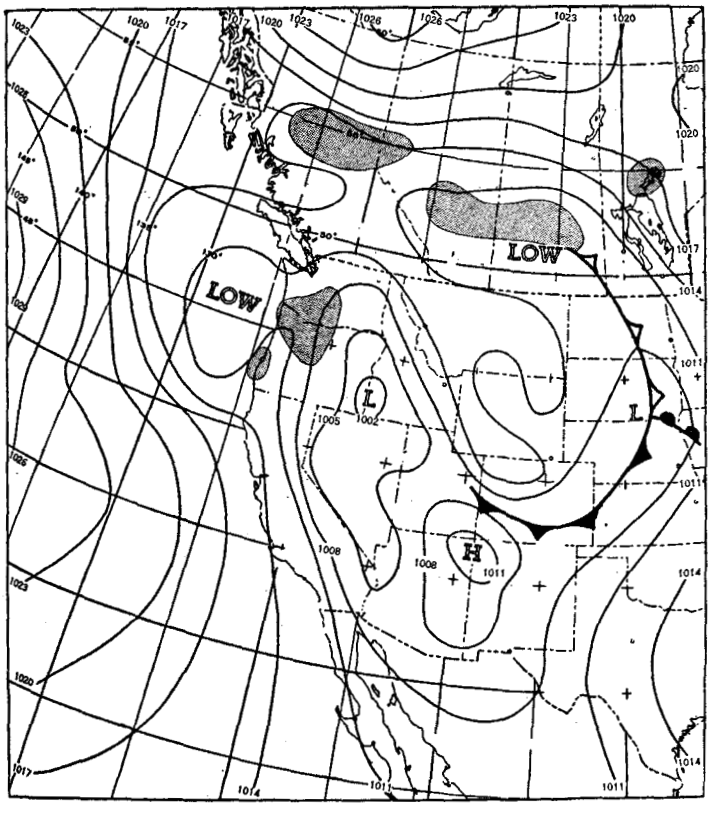

FIGURE 6.—Surface weather map for 1230 GMT, June 11, 1952. Shading indicates areas of active precipitation.

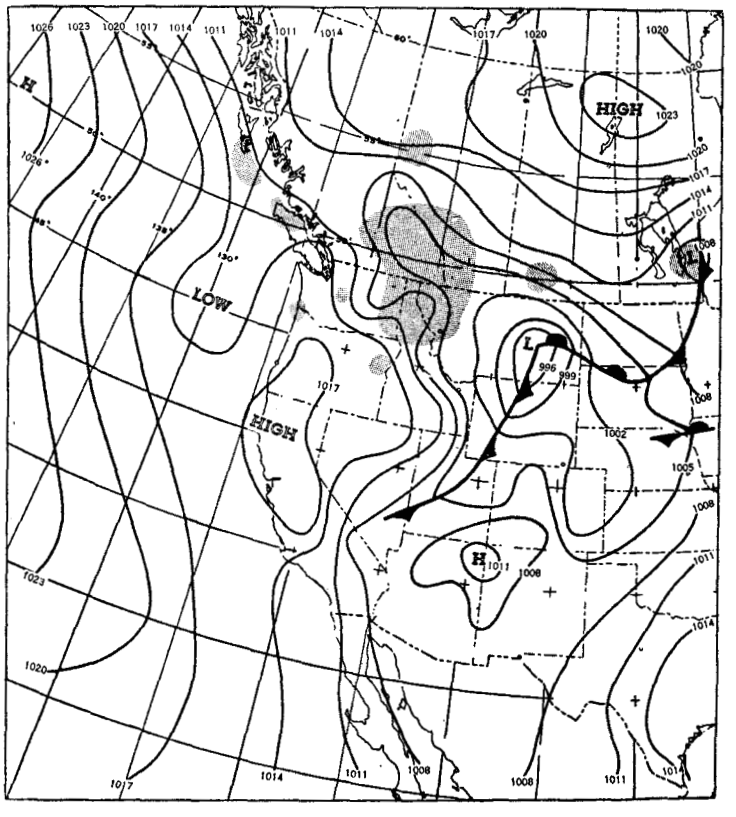

FIGURE 7.—Surface weather map for 1230 GMT, June 12, 1952.

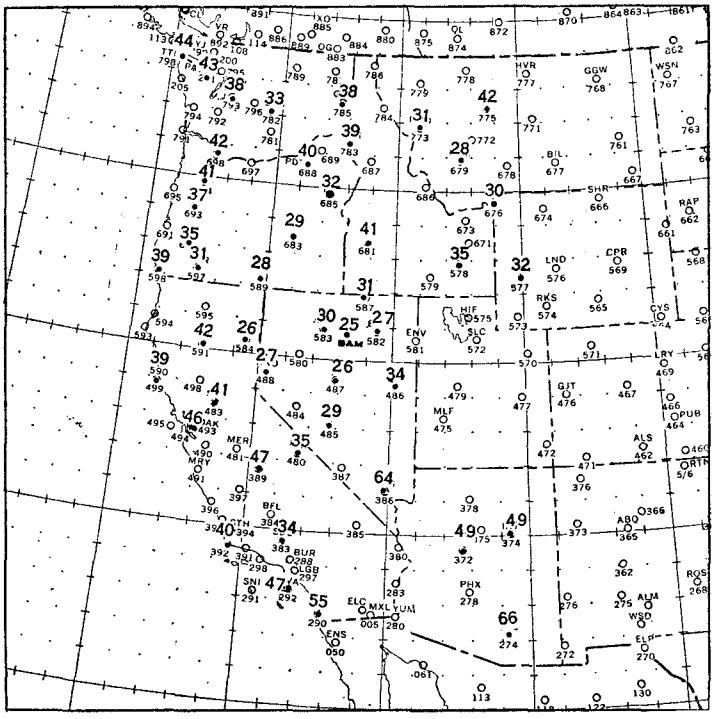

FIGURE 8.—Minimum temperature chart for June 12 and 13, 1952.

Oregon, Washington, and northern Nevada. The following reports of damage are quoted from the June issues of *Local Climatological Data*. Reno, Nev.: "Killing freeze on the 12th caused widespread damage; heavy losses occurred in commercial and home garden plantings of tomatoes, beans, and corn. There are no commercial fruit orchards, but there are many fruit trees in residential plantings. Apricots are practically a total loss; peaches and pears are also hard hit." Medford, Oreg.: "Freezing temperature occurred on the 12th with slight damage to fruit and crops considering the valley as a whole, but some gardens and orchards sustained heavy losses." Spokane, Wash.: "Scattered areas of light frost in the vicinity the morning of the 13th caused considerable damage to tender vegetables and also to the field crops in the lower areas." Mount Shasta, Calif.: "A killing frost on the morning of the 12th completely destroyed most gardens on the valley floor, where temperatures were quite likely as much as 4° or 5° colder than observed at this station."

Most of the coldest temperatures occurred on the morning of the 12th except in Idaho and eastern Nevada where the lowest minima came on the 13th. The main reason for these exceptionally cold temperatures was the deep column of unusually cold air. Of course, radiational cooling, aided by light surface winds, helped lower the surface temperatures during the nights but, due to high moisture aloft throughout this period, radiational cooling apparently was not at a maximum. The few low minima that occurred on the 13th in the Coastal States were due to shallow pools of cold air trapped in the valleys. Generally, however, on the 13th temperatures were rising rapidly along the Pacific Coast, particularly aloft.

SHORT DURATION OF COLD SPELL

An examination of figures 4 and 5 shows initial warming at 700 mb. over California and southern Oregon on the 12th followed by warming throughout the West on the 13th. The 700-mb. temperature at Boise, Idaho rose 9° C. for the period indicated in figure 5 while its 36-hour change for the period ending at 0300 GMT, June 14 was +14.5° C. This rapid warming can be explained after a careful study of the upper level charts over the eastern Pacific. The 700-mb. chart of 1500 GMT, June 10 (not reproduced) shows new but weak cold advection from

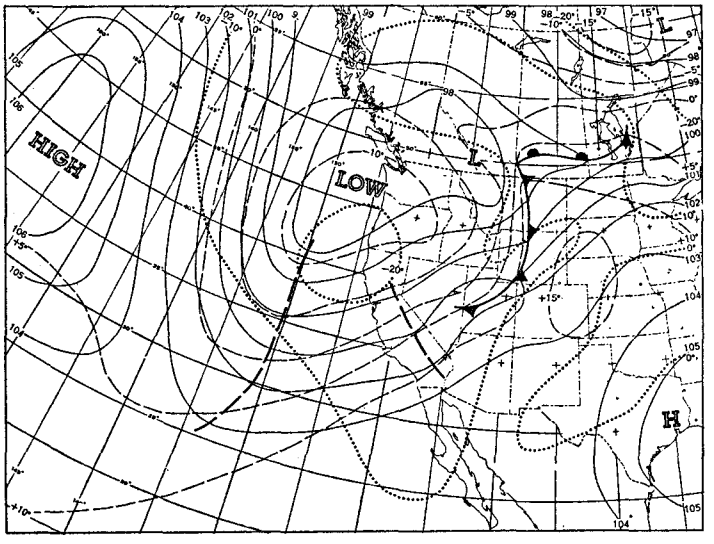

FIGURE 9.—700-mb. chart for 1500 GMT, June 12, 1952. Contours (solid lines) at 100-ft. intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are at intervals of 5° C. Isograms of dew point temperature (dotted lines) are at intervals of 10° C. Heavy dashed line represents low pressure trough.

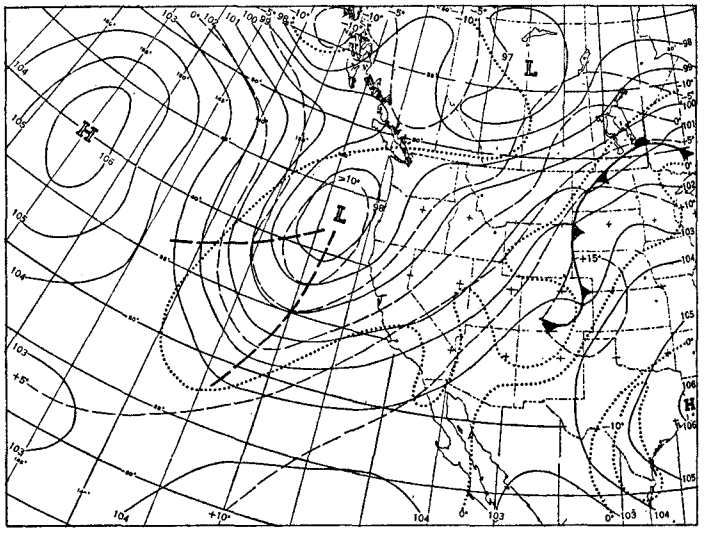

FIGURE 10.—700-mb. chart for 1500 GMT, June 13, 1952. Contours (solid lines) at 100-ft. intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are at intervals of 5° C. Isograms of dew point temperature (dotted lines) are at intervals of 10° C. Heavy dashed line represents low pressure trough.

northwestern Canada toward the south. This air moved into the Gulf of Alaska and by 1500 GMT, June 11 (fig. 2) had resulted in a cold trough moving southward into the major trough. By 1500 GMT, June 12 (fig. 9) this new trough had moved southward off the California coast and deepened so that it now represented the lower portion of the major trough. This deepening off the coast in effect resulted in the retrogression of the southern portion of the major trough.

The 700-mb. winds over California became west-northwesterly at 0300 GMT, June 12 following the passage inland of the trough that accompanied the record-breaking cold air. These winds remained northwesterly for less than 12 hours; the 1500 GMT, June 12 700-mb. chart (fig. 9) shows that the air flow had backed rapidly to the southwest. Temperatures aloft over California, Oregon, and Nevada quickly rose after this wind shift (fig. 4).

Then a third and final surge of cold air entered the picture. The 700-mb. charts indicated further cold air advection south of ship P (50° N., 145° W.) and approaching ship N (33° N., 135° W.) at 1500 GMT, June 13 (figs. 10 and 11). With the approach of this cold air the trough off the California coast moved slowly westward and warming continued over the western States (fig. 5).

By the 13th the lower portion of the major trough had moved to its most westerly position. The 300-mb. chart for 1500 GMT, June 13 (fig. 12) shows a Low near the Washington–Oregon coast with a trough southwestward through ship N. Comparison with the chart for 0300 GMT, June 10 (fig. 1) shows a 90-degree shift in the axis of the major trough. These two maps represent the extremes in orientation of the high level troughs and indicate the rapid changes taking place aloft during this period.

From the 13th on, the trough aloft moved steadily eastward, entered the United States on the 15th, and moved into the Central States. Although on the average temperatures in the Far West remained below normal for the remainder of the month, the minima did not again approach those of the 12th and 13th.

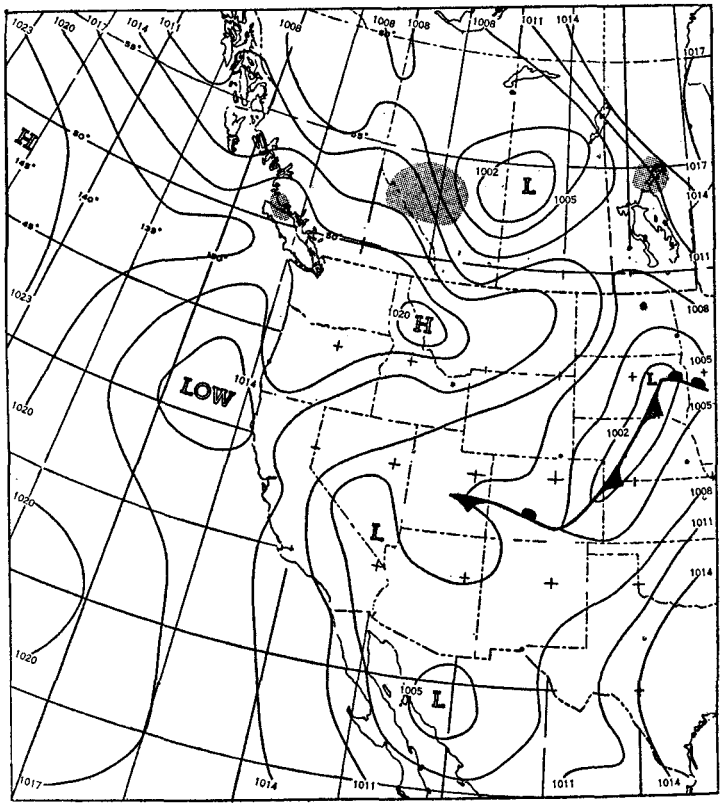

FIGURE 11.—Surface weather map for 1230 GMT, June 13, 1952.

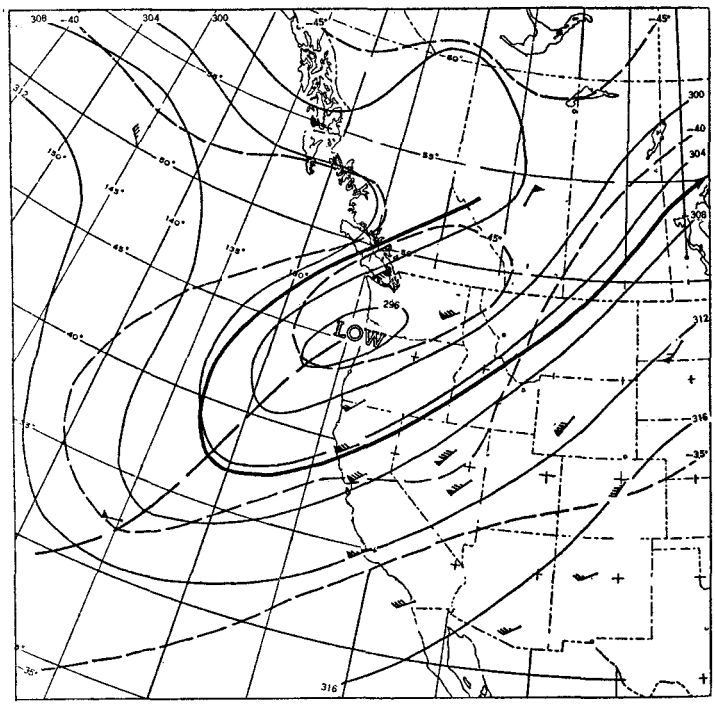

FIGURE 12.—300-mb. chart for 1500 GMT, June 13, 1952. Contours (solid lines) at 400-ft. intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are in intervals of 5°C. Heavy dashed line represents low pressure trough. Heavy solid line represents jet stream. Barbs on wind shafts are for wind speeds in knots; full barb=10 knots, half barb=5 knots, and pennant=50 knots.

REFERENCES

1. William H. Klein, "The Weather and Circulation of June 1952—A Month With a Record Heat Wave", *Monthly Weather Review*, vol. 80, No. 6, June 1952, pp. 99–104.
2. L. W. Sheridan, "A Study of Northern Hemisphere Pressure-Center Tracks", *Transactions*, American Geophysical Union, vol. 26, Part 1, August 1945, p. 49.
3. U. S. Weather Bureau, "Extreme Temperatures in the Upper Air", *Technical Paper* No. 3, Washington, D. C., July 1947.
4. U. S. Weather Bureau, "Temperatures at Selected Stations in the United States, Alaska, Hawaii, and Puerto Rico", *Technical Paper* No. 9, Washington, D. C., December 1948.

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